

NOTES ON THE GENUS *ARCTOSTAPHYLOS*¹

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In the mapping of the vegetation types of California and western Nevada, the species of *Arctostaphylos*, because of their widespread abundance throughout most of the region and because of their great variation, have presented a difficult problem. It has been necessary, in supervising this mapping project during the past twelve years, to devote much time to the study of this genus in the field. In this study we have had the cooperation of the late Dr. Harry S. Yates, botanist of the project, and the active assistance of every field worker on the survey. The senior author has also had invaluable advice and assistance from Dr. W. L. Jepson, of the University of California, not only pertaining to *Arctostaphylos* but to many other botanical problems concerning the vegetation survey.

In differentiating the species of *Arctostaphylos* the presence or absence of a burl at the base of the stem and the character of the nascent inflorescences have proved most valuable. These characters have not been extensively noted or used by previous workers in this genus.

The presence of a burl is related to the capacity of a species to sprout following fire or cutting. Dr. W. L. Jepson in 1916 pointed out the sprouting character of certain species in contrast to the nonsprouting character of others and suggested the value of this criterion for differentiating species (MADROÑO 1: 3-11. 1916). In 1922 he further developed the use of this character as a basis for species differentiation (MADROÑO 1: 76-77. 1922). The senior author, as a student of Dr. Jepson, had become acquainted with this behavior of *Arctostaphylos* in the Mount Tamalpais region. When he was assigned to map the vegetation of the state in 1926 and was requested at the same time to determine the sprouting capacity of each species of the chaparral because of its practical bearing on the construction and maintenance of firebreaks, "sprouting" or "nonsprouting" became the first point of observation in the field identification of all trees and shrubs encountered. A record of this character was entered on the field

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[While this article was in press, Dr. W. L. Jepson, to whom a copy of the manuscript was submitted for criticism on November 17, 1938, published two papers, "Embryonic Panicles in *Arctostaphylos*" (*Erythea* 8: 97. December 22, 1938) and "Three New Californian *Arctostaphyli*" (*l.c.* 8: 99). The use of my name as co-author of *A. pilosula* Jepson & Wieslander, *A. rudis* Jepson & Wieslander, and *A. silvicola* Jepson & Wieslander was unauthorized and without my knowledge or consent. A. E. WIESLANDER.]



FIG. 1. *Arctostaphylos glandulosa*. Development of the burl in a typical sprouting species.

label of each herbarium specimen collected. The sprouting character is, in most instances, readily observable but may be obscured because of lack of evidence of fire. For this reason field workers were often confused. Either sprout regeneration was lacking because no fire or cutting had taken place since the seedling stage or else the layering habit of many of the species was mistaken for sprouting. In an effort to clear up this difficulty we were rewarded by the observation that the burl is not a reaction of the species to mutilation by fire or cutting, as many have understood it to be, but a normal structure which appears early in the life of the seedling as a few nodules, develops steadily with increasing age, and ultimately attains a diameter of a foot or more, even where fires have never occurred. The exterior surface of a large, well developed burl is simply an aggregation of latent buds, which sprout as a result of injury by fire or other agencies. Fire may affect the size and shape of the burl, but is not responsible for its existence. The nature and development of the burl in a typical sprouting species is shown in text figure 1. Since, therefore, the presence of the burl can be observed even in very young plants, its value as a taxonomic criterion is greatly enhanced.

Nascent inflorescences as shown in text figure 2 develop in most species of *Arctostaphylos* during the early summer and remain in this dormant condition until just prior to blooming. In the warm coastal belt of California these structures emerge from the dormant condition soon after the fall rains which initiate growth, but at higher and cooler elevations they remain dormant

until spring. The value of this character in segregating species was first called to our attention in 1931 by Mr. H. A. Jensen, who is associated with us on the type mapping project. On the Hoaglin Quadrangle in Trinity County Mr. Jensen found this character useful in differentiating *A. manzanita* Parry, *A. canescens* Eastw., and *A. viscida* Parry, none of which forms a burl. Although previous use has not been recorded in the literature, Dr. Jepson has informed the senior author that he also had noted the value of the nascent inflorescence character of many of the manzanitas in the Napa region. The usefulness of this character is enhanced by the fact that it is observable over a very long period each year. During subsequent mapping work it has proved an excellent field character for differentiating many of the species. In the following descriptions, special reference is made to the presence or absence of burls and to the nature of the nascent inflorescences.

The type collections are filed in the Vegetation Type Map Herbarium, California Forest and Range Experiment Station, located in the University of California Herbarium at Berkeley. Isotypes have been distributed to the United States Forest Service Herbarium, the United States National Herbarium at Washington, D. C., and the University of California Herbarium. In citing specimens the following symbols represent the various herbaria consulted: VTM, Vegetation Type Map Herbarium; UC, University of California Herbarium; D, Dudley Herbarium, Stanford University; CAS, California Academy of Sciences, San Francisco.

ARCTOSTAPHYLOS SILVICOLA sp. emend. *A. silvicola* Jepson and Wieslander, *Erythea* 8: 101. 1938.

Silvery gray shrub, 20–25 dm. high; no burl formation at base; bark smooth, deep dark red; branchlets densely gray-canescenscent with soft hairs; leaves elliptic to oblong-elliptic, obtuse or apiculate at the apex, rounded-cuneate at the base, densely gray-canescenscent, or occasionally glabrate, 15–40 mm. long, on petioles 3–8 mm. long; nascent inflorescence (text fig. 1, b) short, 9–13 mm. long, sessile or on peduncles 2–4 mm. long, campanulate, pendulous or slightly spreading, 1–3 in a cluster, bracts leafy, lanceolate, 4–12 mm. long, the tips slightly recurved, densely canescenscent, gray green, tinged pink; flowers white, 5–6 mm. long, on glabrous or hairy pedicels; ovary glabrous or rarely hairy; berry globose, slightly depressed at the apex, 5–10 mm., orange brown, glabrous, rarely slightly hairy; nutlets separate.

Distribution. Ridges above Mount Hermon and Bonnie Doon, Santa Cruz County, on marine sand deposits, associated with *Pinus ponderosa*, *Arctostaphylos tomentosa*, *Adenostoma fasciculatum*, *Ceanothus Ferrissae*, *Ericameria ericoides*, and *Lupinus albifrons*.

Specimens to verify range. SANTA CRUZ COUNTY: Mount Hermon, *A. E. Wieslander* 277 (VTM 2467); near Bonnie Doon, *H. S.*

Yates 5020 (VTM 8019); Big Trees, *C. W. Hanks 169* (VTM 8730); Mount Hermon, *H. E. McMinn 1699* (D); Ben Lomond, *A. D. E. Elmer 4606* (D, CAS); near Tuxido, April 17, 1904, *W. R. Dudley* (D, CAS); Scott's Valley, *L. R. Abrams 10903* (D); near Eccles, June 27, 1897, *W. R. Dudley* (D, CAS); above Bonnie Doon, March 29, 1899, *W. R. Dudley* (D); Glenwood, Feb. 7, 1914, *Horace Davis* (CAS); Mount Hermon Ridge, *Beryl Schreiber 2567* (VTM 23756); Felton (Mount Hermon Ridge) *C. M. Belshaw 1482* (VTM 13639); Mount Hermon, *A. E. Wieslander 701* (VTM 17279).

Arctostaphylos silvicola may be distinguished from *A. canescens* Eastw. by its smaller, elliptic leaves. The nascent inflorescence of *A. silvicola* is usually pendulous, although occasionally slightly spreading, and the tips of the bracts tend to recurve, whereas in *A. canescens* they are generally erect or spreading on arcuate peduncles. The ovary and fruits of *A. silvicola* are glabrous, rarely hairy, while in *A. canescens* the ovary is densely long white-hairy and the fruits are usually pubescent or sometimes slightly glandular, or glabrate with a glaucous bloom.

Arctostaphylos silvicola forms large silvery gray masses in the chaparral and is the dominant member of the vegetation growing under *Pinus ponderosa*. It also occurs in nearby pure stands as a fire type replacement of *Pinus ponderosa* in these localities.

ARCTOSTAPHYLOS RUDIS sp. emend. *A. rudis* Jepson and Wieslander, *Erythea* 8: 100. 1938.

Low shrub, to 15 dm. high, forming burls at the base and frequently on the lower branches; bark reddish brown, rough and shreddy; branchlets finely gray-pubescent; leaves elliptic to oblong, occasionally oval, usually rounded at the base, or occasionally truncate, apiculate or obtuse at the apex, glabrous or lightly pubescent especially on the young leaves, bright green, 15–30 mm. long, on pubescent petioles 3–6 mm. long; nascent inflorescence (text fig. 2, e) short, oblong, 5–6 mm. long, 1–3 at the tips of the branchlets, pendulous, bracts mostly scalelike, ovate to awl-shaped, acute or acuminate, when acuminate the tips recurved, 2–3 mm. long, reddish or pale green, finely pubescent; flowers 5–6 mm. long, on glabrous pedicels, pinkish; ovary glabrous; fruit globose, 9–11 mm. wide, glabrous, light brown or reddish brown when mature; nutlets separate.

Distribution. Dune sands near Oceano, San Luis Obispo County, south in the vicinity of Lompoc, Santa Barbara County, 150–600 feet elevation, associated with such plants as *Arctostaphylos pechoensis* var. *viridissima*, *Ceanothus dentatus* var. *impressus*, *Rhamnus californica*, *Adenostoma fasciculatum*, *Salvia mellifera*, and *Ericameria ericoides*.

Specimens to verify range. SAN LUIS OBISPO COUNTY: Oceano, *N. French 663* (VTM 13592); near Los Berros, *A. E. Wieslander*

136 (VTM 2528). SANTA BARBARA COUNTY: Corralillos Canyon, *A. E. Wieslander* 577 (VTM 12520); Surf, *G. E. Sindel* 179 (VTM 8390); Burton Mesa, *H. S. Yates* 6534 (VTM 19229); Lompoc Mesa, *A. E. Wieslander* 235 (VTM 2286); Burton Mesa, *H. L. Mason* 11770 (UC); Lompoc, March 3, 1937, *E. Denys Rowe* (UC); Lompoc Moor, *Ralph Hoffmann* 376 (CAS); 4 miles southeast of Lompoc, *Roxana S. Ferris* 7605 (D); Lompoc Mesa, *Beryl Schreiber* 2562 (VTM 23749); Lompoc Mesa, *A. E. Wieslander* 644 (VTM 15473); Point Sal, *A. E. Wieslander* 813 (VTM 23744).

Arctostaphylos rudis is distinct from all other coastal manzanitas which form burls. The shaggy fibrous bark separates it from the *A. glandulosa* Eastw. group and the small, elliptic, glabrous or glabrate leaves distinguish it from the *A. tomentosa* Lindl. group. The nascent inflorescences including the peduncles are shorter and more slender than in either the *A. tomentosa* or the *A. glandulosa* complex, and the fruit is glabrous, polished, considerably larger, and more profuse.

Arctostaphylos morroensis sp. nov.

Frutex 15–20 dm. altus; caudex etumescens; cortex asper laciniosus porphyreus vel cinereo-fuscus; ramuli pubescentes pilis adpressis, densis brevibus, interdum pilis longis rigidis admixtis; folia 15–30 mm. longa oblonga vel raro elliptica, plerumque truncata, aliquando basi subcordata vel raro rotunda, apice plerumque apiculato, aliquando obtuso, flavovirentia vel cinereo-viridia, subtus dense tomentosa supra sparse pilosa vel glabra; petioli 2–4 mm. longi; inflorescentia nascens 7–9 mm. longa solitaria numerosave in axillis foliorum superiorum aggregata; bractae foliaceae, lanceolatae minute pubescentes, aliquando pilis rigidis admixtis; pedicelli glabri; corolla alba vel puniceo-tincta 5–7 mm. longa; ovarium dense pubescens; drupa matura diametro 10 mm. globosa vel paullo depressa, aurantiaco-ferruginea, sparse pubescens; pyrenae liberae.

Shrub 15–20 dm. high; no burl formation at the base; bark rough and shreddy, red brown or gray brown; branchlets appressed-pubescent, and with dense, short, or long bristly hairs, or the latter lacking; leaves oblong to rarely elliptic, 15–30 mm. long, usually truncate but frequently subcordate or rarely rounded at the base, apex usually apiculate but occasionally obtuse, on petioles 2–4 mm. long, yellowish green or gray green, densely tomentose on the under surface, sparingly pubescent to glabrous above; nascent inflorescence (text fig. 2, a) short, campanulate, 10–14 mm. long, 1 to several, clustered in the upper leaves, mostly pendulous, bracts leafy, lanceolate, 7–9 mm. long, and finely pubescent, coarsely bristly or bristles lacking; flowers white to pink tinged, 5–7 mm. long, on glabrous pedicels; ovary densely pubescent; fruit globose, or slightly flattened, orange

brown when ripe, 10 mm. in diameter, lightly pubescent; nutlets separate.

Types. Nascent inflorescence: south of Morro Bay (Hazard Canyon), San Luis Obispo County, 200 feet elevation, October 7, 1938, *Beryl Schreiber 2554* (VTM 23740). Flowering specimen: 0.4 mile north of Hazard Canyon (south of Morro Bay), 200 feet elevation, January 31, 1936, *Ben Bolt 561* (VTM 13800). Fruiting specimen: south of Morro Bay (Hazard Canyon), 250 feet elevation, May 12, 1936, *A. E. Wieslander 639* (VTM 15468).

Distribution. Sandy hills south of Morro Bay, 100–400 feet elevation, associated with *Adenostoma fasciculatum*, *Salvia mellifera*, *Lotus scoparius*, and *Ericameria ericoides*.

Specimens to verify range. SAN LUIS OBISPO COUNTY: Morro Bay, *A. E. Wieslander 640* (VTM 15469); Hazard Canyon, *A. E. Wieslander 647* (VTM 17235); Los Osos Ranch, *N. French 709* (VTM 14085); Osos Creek, *B. Bolt 541* (VTM 13783); Valencia Peak, *B. Bolt 644* (VTM 14631); Morro sands, *Alice Eastwood 14945* (CAS); Haynes Ranch, Morro Bay, July, 1912, *Mary Page Ingalls* (CAS); road to Pecho, *Alice Eastwood 15107* (CAS, D); Morro Bay on road to Pecho, February, 1929, *Gertrude Sinzheimer* (UC, D).

Arctostaphylos morroensis may be distinguished from *Arctostaphylos tomentosa* by the absence of a burl at the base of the shrubs. In all of the *A. tomentosa* series burls were formed even on the young seedlings, these developing into great massive growths on the mature plants. The nascent inflorescences of *A. morroensis* are campanulate, while those of *A. tomentosa* are oblong and more rigid or spikelike. Characteristically the leafy bracts in *A. morroensis* are coarsely bristly ciliate but these bristles are occasionally lacking. The bracts of *A. tomentosa* are usually merely pubescent. The pedicels in *A. morroensis* are glabrous, whereas in *A. tomentosa* they are pubescent.

Arctostaphylos morroensis is the common shrub in the chaparral at the south end of Morro Bay, frequently forming compact masses over extensive areas. It has been reported as far south as Valencia Peak, 2.5 miles south of the type locality (*B. Bolt 644* (VTM)). The specific name is derived from the locality where the species is found.

Arctostaphylos otayensis sp. nov.

Frutex erectus, 10–25 dm. altus; caudex etumescens; cortex laevigatus, atroruber; ramuli breves glandulosi-pilosi; folia 13–35 mm. longa elliptica vel oblonga, apice acuto apiculatove basi rotunda vel raro truncata utrinque minute pubescentia sub microscopio glandulosa raro glabrata cinereo-viridia vel flavovirentia; inflorescentia nascens breve oblonga 10–20 mm. longa, 3–8, in apicibus ramulorum terminalis, foliis supremis proximis subtendita, erecta vel alabastris crescentibus paullo arcuato-adscentens; bracteae 3–15 mm. longae foliaceae, glanduloso-pilosae;

pedicelli glanduloso-pilosi; drupa 5–8 mm. diametro globosa pallidissimo-ferruginea, nitida glabra, sparse pilosa vel sub microscopio glandulosa; pyrenae liberae per occasionem in nucem osseam coalescentes.

Erect shrub, 10–25 dm. high; no burl formation at base; bark smooth, dark red; branchlets short glandular-hairy; leaves elliptic to oblong, acute or apiculate at the apex, rounded or rarely truncate at the base, 13–35 mm. long, on petioles 4–7 mm. long, finely pubescent on both surfaces and microscopically glandular, rarely glabrate, gray green or yellowish green; nascent inflorescence (text fig. 2, d) short oblong, 10–20 mm. long, 3–8 in a cluster at the tips of the branches, closely subtended by the leaves, erect or slightly curved upwards as the buds develop, bracts leafy, lanceolate, 3–15 mm. long, glandular-hairy, green, tinged red, or yellow green; flowers white, 5–7 mm. long, on glandular-hairy pedicels; ovary glandular-hairy or sparsely glandular-hairy; berry globose, 5–8 mm. wide, very pale brown, shining, glabrous, sparsely hairy, or microscopically glandular; nutlets separate, or coalesced into a solid nut.

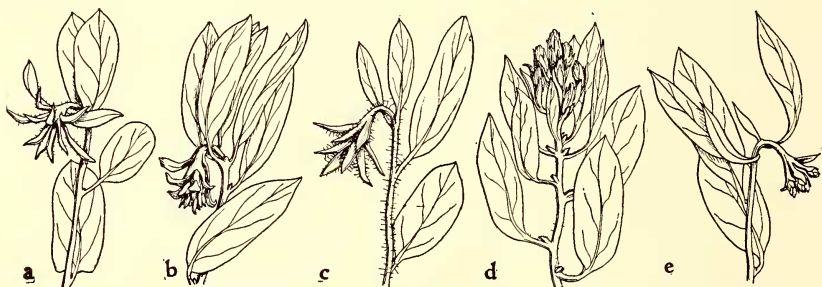


FIG. 2. Nascent inflorescences in *Arctostaphylos*: a, *A. morroensis*; b, *A. silvicola*; c, *A. pilosula*; d, *A. otayensis*; e, *A. rudis*.

Types. Nascent inflorescence: Otay Mountain, San Diego County, 3200 feet elevation, November 3, 1937, *H. A. Jensen* 437 (VTM 22379). Flowering specimen: Otay Mountain, 3000 feet elevation, January 23, 1934, *A. E. Wieslander* 350 (VTM 3476). Fruiting specimen: San Ysidro Mountains (on Otay Mountain), 1800 feet elevation, June 11, 1935, *A. E. Wieslander* 552 (VTM 12510).

Distribution. In chaparral on Otay Mountain, San Diego County, 1800–3600 feet elevation, associated with *Adenostoma fasciculatum*, *Arctostaphylos glandulosa*, *Rhus laurina*, *Ceanothus crassifolius*, *Chamaebatia foliolosa* var. *australis*, and at the elevation of 1800 feet in the Tecate cypress association associated with *Arctostaphylos bicolor*, *A. glandulosa*, *Cercocarpus betuloides*, *Comarostaphylys diversifolia*, and *Chamaebatia foliolosa* var. *australis*.

Specimens to verify range. SAN DIEGO COUNTY: Otay Mountain, *A. E. Wieslander* 351 (VTM 3277); *N. French* 279 (VTM 4936).



PLATE 4. BURL FORMATION AND EFFECTS OF FIRE ON ARCTOSTAPHYLOS. Fig. 1. *Arctostaphylos rudis* showing shreddy bark and burl formation at base. Fig. 2. *Arctostaphylos glandulosa* (foreground) sprouting from burls after fire; *Arctostaphylos otayensis* (background) killed by fire.

Arctostaphylos otayensis, although resembling *A. glandulosa* in many respects, differs from that species in that no burls are formed and the plants are, therefore, killed outright by fire (pl. 4, fig. 2). The fruit of *A. otayensis* is characteristically small and very pale brown in color, shining, microscopically glandular, and usually glabrous but occasionally sparsely hairy. In *A. glandulosa* the fruits are red brown in color when ripe and usually very viscid, or glands lacking. The specific name is derived from the type locality, Otay Mountain.

ARCTOSTAPHYLOS PILOSULA sp. emend. *A. pilosula* Jepson and Wieslander, *Erythea* 8: 101. 1938.

Erect shrub, 10–30 dm. high; no burl formation at the base; bark dark red brown, smooth; branchlets pubescent, and with long or short bristly hairs, or these sparse, or occasionally lacking; leaves oblong, elliptic to ovate, 15–45 mm. long, on petioles 5–9 mm. long, truncate or rounded at the base, rarely subcordate, occasionally small teeth at the base, apex apiculate, or merely acute, glaucous green or yellow green, (bright green in one form from Sycamore Springs, branches then densely long hairy), glabrous, or sparsely pubescent on both surfaces, young leaves on new twigs densely silvery-tomentose; nascent inflorescence (text fig. 2, c) short, campanulate, 10–14 mm. long, 1–2- rarely 3-clustered at the tips of the branches, mostly pendulous, bracts leafy, 5–14 mm. long, lanceolate, finely pubescent to glabrous, and usually with coarse bristles but these occasionally sparse or lacking, bright green, tinged reddish, or glaucous green; flowers white, tinged pink, 4–7 mm. long, on glabrous or slightly hairy pedicels; ovary usually glabrous (except in one form from near Los Berros); berry depressed globose, 8–10 mm. wide, glabrous, orange brown or red brown, usually with blue-black vertical stripes when mature; nutlets separate.

Distribution. Chaparral areas of San Luis Obispo County, 200 to 3600 feet elevation, associated with shrubs of *Adenostoma fasciculatum*, *Salvia mellifera*, *Eriogonum fasciculatum*, *Lotus scoparius*, and in the La Panza range associated with *Pinus Coulteri*.

Specimens to verify range. SAN LUIS OBISPO COUNTY: Dove, D. I. Axelrod 555 (VTM 17461); Edna, A. E. Wieslander 646 (VTM 17234); Price Canyon, H. C. Lee 427 (VTM 14053); Indian Knob, H. C. Lee 392 (VTM 14019); Sycamore Springs, A. E. Wieslander 580 (VTM 12522); Los Berros Creek, H. C. Lee 425 (VTM 14051); Summit, H. C. Lee 242 (VTM 15247); Porter Ranch, C. M. Belshaw 1690 (VTM 14317); Suey Creek School, H. C. Lee 618 (VTM 15632); Park Ranch, H. C. Lee 578 (VTM 15593); Tar Springs Ranch, H. C. Lee 572 (VTM 15587); New District School, A. D. Gifford 820 (VTM 19640); American Canyon, A. E. Wieslander 261 (VTM 2237); La Panza range, A. E. Wieslander 538 (VTM 8434); La Panza, W. A. Peterson 652 (VTM 19249); La Panza, D. I. Axelrod 538 (VTM 17467); Edna, Beryl